

Measuring the expected increase in cycling in the city of Milan and evaluating the positive effects on the population's health status: a Community-Based Urban Planning experience

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Key words: Urban Health, Physical Activity, Active Transport, Community-Based Urban Planning, questionnaire

Parole chiave: Urban Health, Attività fisica, Trasporto attivo, Community-Based Urban Planning, Questionario

Abstract

Background. It's scientifically known that inactivity is one of the major risk factors for Non-Communicable Diseases. One of the elements affecting the choice of transport mode, regarding circulation in the city, is the cities' urban morphology, i.e. the infrastructural facilities for the slow mobility service. Cyclability, in fact, can help to increase daily physical activity level, therefore becoming a protective factor for individual health.

Methods. After a literature review about the state of the art regarding the correlation between built environment, active transport and quantification of the physical activity level, we have developed a specific questionnaire to collect information about current and forecast use of bicycle, in case of improvement and implementation of the cycling network. The questionnaire also investigated social and health aspects concerning the anamnesis of the interviewees (age, gender, health status, sport activity performed, etc) and users' opinions about existing infrastructure and planned interventions, designed to promote cycling mobility. Aim of the research was to quantify the increase of physical activity people would have realized in front of an improvement of the specific infrastructures, and the expected positive effects in terms of health.

Results. The collected data (343 interviewed in a district of Milan, named "Zona 7") demonstrate that through the implementation of the cycle network, there would be more cyclists to practice the 150 minutes weekly of physical activity recommended by WHO: time spent in cycling, indeed, would increase by 34.4% compared to the current level of cyclability, as detected by our survey.

Conclusion. The investigation confirmed that urban interventions, especially those in small-scale, could play a key role in the promotion of healthy lifestyles, inducing therefore important positive effects on the population health. It was also carried out an application of the WHO "Health Economic Assessment Tool" to evaluate the benefits in terms of Non-Communicable Diseases' reduction, specifically a provisional quantification of deaths saved.

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Introduction

Many associations and local authorities are trying to address the health issues that arise in the urban context. As a relatively new research discipline, “Urban Health” focuses on the elaboration and application of strategies that are meant to protect and promote health in the urban environment. Urban planning policies have the potential to affect both directly and indirectly, positively or negatively, the physical and psychological well-being of a town (1).

A focus on “Urban Health” implies making more conscious choices, aiming at improving not only health but also the quality of life (2). It is with this goal in mind that the World Health Organization (WHO) has founded the “Healthy Cities Network”, now involving dozens of cities and towns engaged in promoting their citizens’ health, both indoors and outdoors.

In contrast to the epidemic diseases of the past, town inhabitants are nowadays frequently affected by non-communicable diseases (NCDs) such as cardiovascular diseases, respiratory diseases, diabetes, cancer, obesity, depression, etc. NCDs now account for most of the deaths in the world (92% in Italy alone), putting a great strain on the budgets of national health services (3). In 2014, 68% of the world’s deaths (38 out of 56 million) were caused by NCDs, amounting to 47% of the world’s diseases (4). In addition to that, recent studies have shown that 6-10% of the deaths for which NCDs are to be blamed (2.5-4 million per year) are caused by physical inactivity, one of the main risk factors together with tobacco consumption, unhealthy diets and alcohol abuse (5). As the curvilinear connection between physical activity (PA) and the risk of NCDs occurring suggests, even a small increase in PA can lead to a significant risk reduction, primarily among physically inactive people (Figure 1) (6).

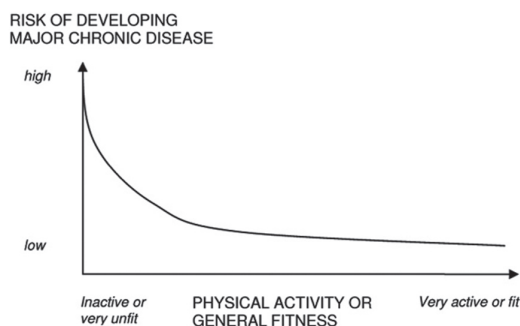


Figure 1 - Correlation between PA and the risk of developing a major chronic disease. Source: At least five a week, evidence on the impact of physical activity and its relationship on health – Chief Medical Officer/ Department of Health (2004)

A regular PA represents a basic preventive measure against many diseases, including heart disorders, strokes, respiratory diseases, diabetes and cancer, as well as mental health issues (7). Research shows that reaching the minimum levels of recommended PA leads to a 20-30% reduction of the morbidity and mortality risk related to cardiovascular diseases, while the risk of suffering a stroke is reduced by 27%, in comparison to the risk run by physically inactive people (8).

The risk of type 2 diabetes mellitus also drops by 30% (9-11). PA also plays a role in decreasing cancer risk, with a 40-50% reduction for colon cancer (12), a 20-30% reduction for breast cancer (11, 13), and a 20% reduction for ovarian and lung cancer (11). Moreover, evidence suggests an impact of PA in fighting obesity (11) and bone, muscle and joint diseases (12, 13). Needless to say, a more active town population is not only healthier but also helps healthcare services contain their spending.

Given that anyone’s ability to be physically active in an urban area is inevitably influenced by its layout; policy makers, architects and town planners have a major role in determining strategies aimed

at protecting and promoting health in such an environment (12, 13).

According to WHO, only 40% of the world's population reaches levels of moderate PA, which the same organization quantifies, at least for adults, in 150 minutes per week (30 minutes per day for 5 days) (14, 15). Furthermore, in Europe 50% of urban travel by car covers a distance of fewer than 5 km (16), roughly equivalent to a 15-20 minute bike ride, which would be enough to reach the recommended levels of PA, and would also improve the economic sustainability of the national health service. It goes without saying that an increased use of the bike for daily trips would have positive effects on the environment as well, with a reduction in pollution, traffic, etc.

Objective

The purpose of this research is to measure the current level of cyclability in the city of Milan and a predictable increase as a result of specific interventions on the existing cycling infrastructure.

The survey, conducted with the help of a specifically prepared questionnaire, also aims to identify the strengths and weaknesses of the cycling infrastructure as perceived by the cyclists in the city of Milan. In addition to that, it meant to assess the users' availability on choosing a different means of transport for their daily movements.

Consequently, this will make it possible to quantify the daily PA (both the current frequency and expected increase) resulting from cycling and analyse how it is possible to improve on it through careful town planning. The collected data will also be useful to measure the health status of the population, in order to develop community-based urban planning strategies. For this purpose, the research uses the "Health Economic Assessment Tool" (HEAT), a software developed by WHO's Regional Office for Europe, so as to estimate the impact on health and the economic benefits related to

a reduction of the mortality risk owing to the expected increase in cycling.

Methods

The first stage of the research is a comparative look at the literature on the topic being investigated. The "*state of the art*" described in the introduction was defined referring to the correlation between urban environment and Active Transportation, then PA and health's benefits (17). Different scientifically validated tools and methodologies were used in order to assess the expected increase in PA ascribable to an improvement of the transport infrastructure (18, 19). In particular, several evaluation methods of the urban context (20), based on the distribution of a questionnaire, were utilized to quantify the level of PA. The most important of which are: *International and Global Physical Activity Questionnaire* (21-23), *International Prevalence Study on Physical Activity* (24), *Questionario sui progressi delle aziende sanitarie per la salute in Italia* (24). Owing to the fact that none of these take into consideration data relating to an increase in PA, especially in the form of cycling, specific questions were tailored to serve the purpose of this research.

An *ad hoc* questionnaire, available in digital and paper form and comprising 30 closed-ended questions, was prepared, as a result of the collaboration of a multidisciplinary research group (experts in health, hygiene, epidemiology, statistics, economic evaluation professionals and architects specialized in urban planning). The questions also aim to collect the relevant information for the "*Health Economic Assessment Tool*" (HEAT) (26) software application.

They are divided into three macro-areas: 15 ask the interviewee about personal data (age; gender; profession; possible smoking

habits; health condition, with a particular focus on NCDs; affliction or inherited predisposition to some diseases); 12 are about his or her actual and expected cycling frequency and the way they move around the city. Lastly, 3 questions ask the interviewee about his or her opinions and advices on existing cycling infrastructures, the degree of satisfaction concerning what has been done to improve cycling mobility and the “*willingness to pay*” to understand the population’s interest on the issue.

The questionnaire for cycling level quantification (current frequency and expected increase)

The preliminary questions mean to ascertain that the interviewees are residents of the area covered by this enquiry or otherwise spend much of their time in it. Next come the questions regarding personal information such as: gender, age and profession. More specific questions concern their own or their closest family members’ health status: in particular, the affliction or inherited predisposition to autoimmune diseases and/or NCDs, such as cardiovascular diseases and diabetes.

The questionnaire continues by asking the interviewees to determine the amount of PA in their everyday life, and in particular, what kind of sport they usually practice (gym, jogging, tennis, football, swimming, etc.) and how frequently (days per week); what means of transport they use and how frequently they travel by bike (minutes and days on a weekly/monthly basis). If the interviewees have never ridden a bicycle, they are asked to give 3 reasons among the suggested ones (they cannot ride a bike, they find it uncomfortable, owing to their age or health, they deem the cycling infrastructure maintenance to be neglected, etc.). The answers on the frequency of use of the bicycle are essential, as they can subsequently be compared with the data collected with the question “*Would you use*

your bike more often if new bike sharing services were to be installed along your usual route and knowing they would be well maintained, well lit and would be convenient for your everyday trips?” The comparison between the current frequency of use and its expected increase allows an evaluation of the growth in expected cycling as well as a consequent evaluation of the benefits brought by an increase in PA.

The survey also comprises questions on the conditions of the existing cycling paths in the area. More specifically, interviewees are asked in a multiple-choice format (*dissatisfied/less satisfied/satisfied/completely satisfied*) to express their satisfaction with aspects such as: the clarity of the road signs, the distance covered, the continuity and extensiveness in the area, the connection with services and infrastructures, the safety, the cleanliness, the maintenance, the road conditions, etc.

The questionnaire also asks which actions the town authority should adopt so as to promote cycling as a means of transport, such as: adding new bicycles to the bike sharing service, improving cycling paths, allowing the possibility to take bicycles on buses, etc.

Lastly, 3 questions might be of great interest to policy makers and relate to: the willingness to accept a decrease in the number of parking lots close to home, the willingness to give up a certain degree of comfort, the hypothetical use of the bike sharing service for daily trips, and the percentage of the town budget for traffic and transport that should be allocated to improve the cycling infrastructures.

Analysis and data comparison

In order to analyse and evaluate the collected data, a specific comparison chart (Pivot-table) was drawn up, using Excel software. This model of analysis allows us to systematise the answers to the questionnaire in order to extrapolate meaningful evaluations

For example, it was possible to compare both the current use of bikes and its expected future increase to the health conditions of the sample group and their inherited predisposition to some diseases, as well as to the users' satisfaction about the current cycling network or the interventions that the sample considers a priority in order to promote sustainable mobility and active transport.

The survey was performed in a section of Milan, specifically in District 7, with the involvement of a random sample of inhabitants (residents, workers, students, etc.) for a period lasting roughly 80 days. The questionnaire, whose digital format ensures the reaching of a wider population, especially among the youth, was created with the “Google forms” service, and then sent to the mailing-lists of associations, sporting clubs, libraries and socio-political local centres. On the other hand, the paper version was handed out over the course of direct interviews in weekly markets, community centres and other urban spaces during public events. This allowed the reaching of that segment of the town population with little opportunity or familiarity with the access to digital technologies and social networks.

The survey was conducted for the first time in an area of Milan (District 7: 170.839 inhabitants) to evaluate the effectiveness of the questionnaire. The population which has proven interest in the topic and has been available to complete the survey reached 343 citizens (2 per thousand of the inhabitants). Such a sample proved to be representative and homogeneous, both in

Table 1 - Description of the sample

	women						men						Total
	<20	>66	21-35	36-50	51-65	Totale	<20	>66	21-35	36-50	51-65	Totale	Total
Student	9		24	1		34	6		22			28	62
Office worker			14	30	13	57			10	18	16	44	101
Freelancer			1	16	14	31		3	3	15	10	31	62
Pensioner		16			8	24		20			2	22	46
Unemployed				4		4		1	1	6	3	11	15
Other			2	16	19	37			2	13	5	20	57
TOTAL	9	16	41	67	54	187	6	24	38	52	36	156	343

terms of gender (54.5% women and 45.5% men) and territorial representation of the 8 neighbourhoods in which the District 7 is divided. As to the interviewees' age, the most active part of population (between 20- and 65-year-old) represents 84% of the sample (Table 1), and actually are the ones most interested and apt to cycling activity. The majority of it appears to be active: 58% of those interviewed practice sport regularly (at least once a week) while 41.7% do not practice any sport.

Concerning the goal of the research and the evaluation of the expected increase in daily PA, as related to a possible improvement of the cycling infrastructure, it was noted that the current use of bikes is limited to 68% of the sample, with a daily average use of 10 minutes throughout the year (25.6 min per 143 days a year). If the cycling infrastructure were improved, that would significantly change, as the data show: 86.6% would use their bike for about 16.3 min a day (30.4 min per 196 days a year).

It should be noted an improvement related to the number of people that would use the bike (+17.8%), the average time (+19%) and the number of the days (+37%) in a year in which they will make this choice in favour of active transportation. (Figure 2).

As to the cycling frequency, the graph shown in Figure 3 highlights a relevant increase among those who ride a bike at least 2-3 times a week or more, as well as an obvious corresponding decrease among those who do it more occasionally or simply do not move around by bike. In addition, it should be noted that, given the frequencies of weekly use necessary for a good level of PA (2-3 times a week or more), we would have an overall growth of 32.6%. As of today 38.2% of the sample travels by bike with such frequency. In the future the percentage might rise to 70.8% (Figure 3).

Furthermore, an increase in the use of bikes would likely correspond to a

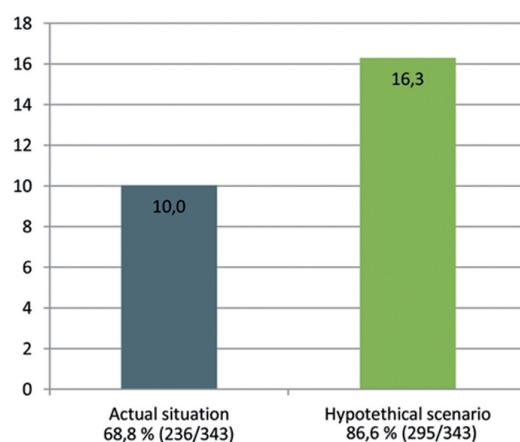


Figure 2 - Annual average minutes of cycling per day.

simultaneous decrease in pollution and congestion, as in 43.7% of the cases, people would use them to replace their private motor vehicles (or, at least, to replace the present frequency of use).

56% of the sample also declares that they would be willing to use a bike-sharing service, which is quite popular in the city of Milan: named "BikeMI" and operated by the Public Transportation Company ATM, is the fourth biggest in Europe.

Those who never use a bike (1/3 of the sample, equal to 107 out of 343 interviewees) or use it only occasionally (another 1/3 of the sample, 105 interviewees) justify their behaviour mentioning a perceived insecurity related to road accidents (37.6% of the total sample) and the limited size of the infrastructure (35%). The current cycling network appears unsafe and unable to properly connect all the urban points of interest (27).

This last aspect is also confirmed by the low level of satisfaction with the network, as shown by the sample of population that often uses the bicycle for active mobility. Habitual users declare a high average dissatisfaction (from 55% to 90% related to all the parameters upon which they were

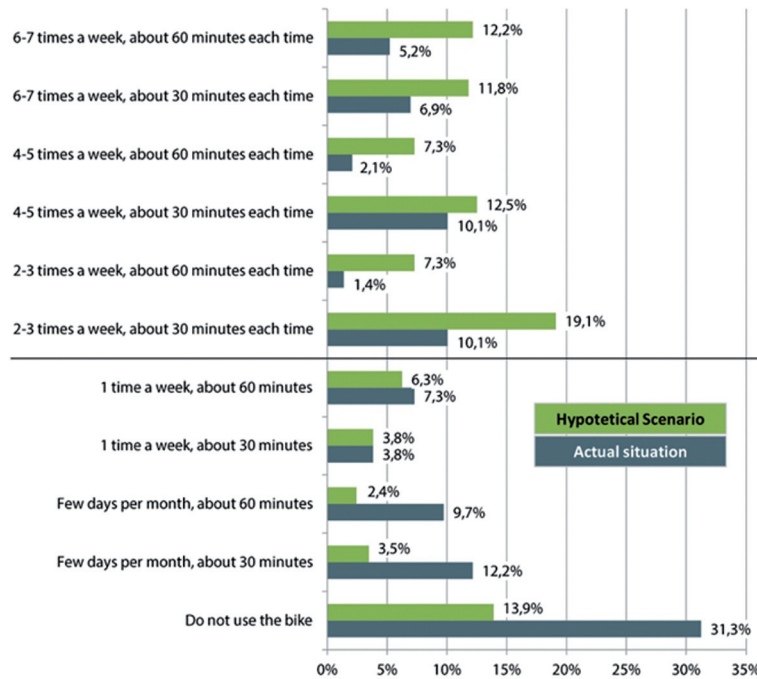


Figure 3 - Comparison between the current intensity of weekly cycling and the expected increase in the future scenario

interviewed). Asked to express an opinion on the extensiveness and *continuity* of cycling paths in neighbourhoods, 86% of the interviewees answered negatively: 51% unsatisfied and 35% slightly satisfied.

The present connection of the cycling network to infrastructural nodes and the presence of dedicated lanes for cyclists also garnered generally negative answers (more than 80%). On the other hand, two aspects that obtained a more positive evaluation on the interviewees' part are the quality of the lighting (41.4% of positive answers) and the clarity of the road signs (35.2% of positive answers) (Figure 4).

These data should be analysed in the prospect of an infrastructural regeneration, as it clearly highlights those issues whose addressing should be prioritized in order to improve the quality of the network and promote active mobility. This also confirms the importance of the correlation between

the quality of the infrastructure and the population's PA level.

Moreover, 61.8% of the sample group would agree with a decision by the local authority to allocate more money, from the budget for transport investments, to cycling paths. On the other hand, another 31.2% declares not to be able to answer the question. Only 7% do not agree.

This all goes to show that the population is in favour of active mobility and would enjoy a more extensive, safe and efficient cycling network. They would agree to spend more money for active mobility even in connection with a reduction in expenditures related to private mobility. More specifically, 17.6% of the sample group state that the interventions to which more resources should be allocated are related to the improvement of cycling paths, while a similar percentage would like more money to be invested in the creation of pedestrian paths.

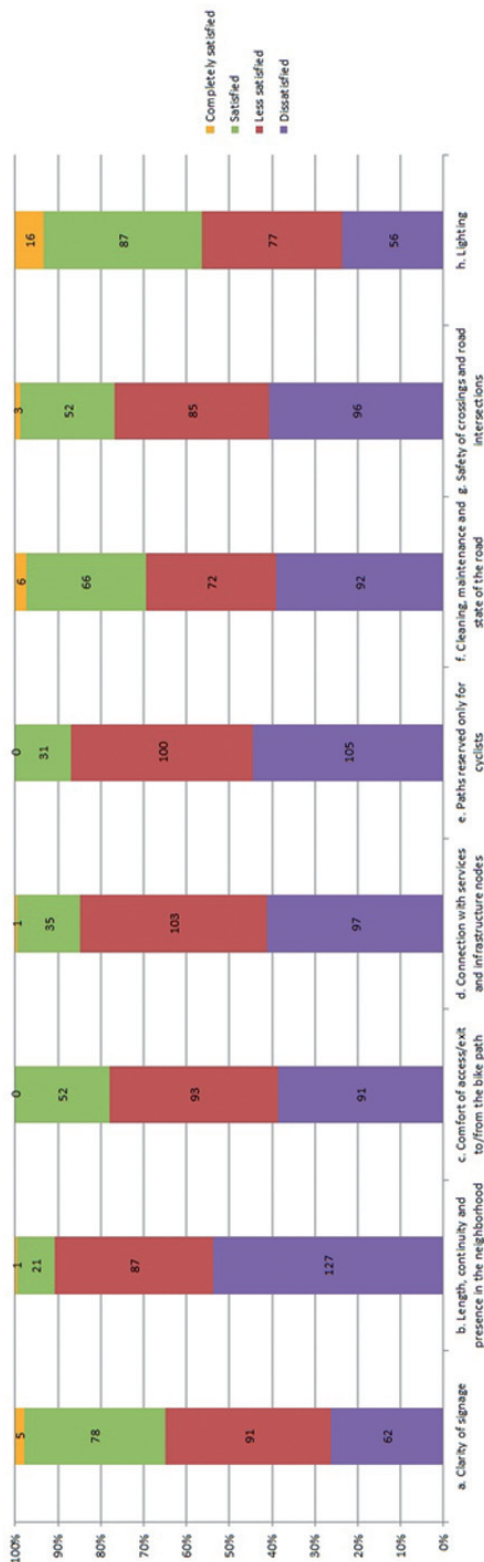


Figure 4 - Satisfaction with the current cycling infrastructure.

Discussion and conclusions

All in all, this study confirms the theory that urban interventions can have important positive effects on people’s health and it results very important to conduct evidence based experiences (28). Districts with well maintained, safe and extensive infrastructures for mobility promote a more active approach to transport and contribute to reaching the recommended levels of PA suggested by WHO (29). As of today, the number of people using bikes 2-3 times a week or more is 38.2% of the sample located in District 7, while in the future it could reach 70.8%.

An increase in the use of bikes would also have positive effects on society, coinciding with a reduction in pollution, traffic (43.7% of the sample group would replace their private motor vehicles), road accidents and a greater quality of community spaces and relationships.

The collected data lends itself to further evaluations, adding to the effectiveness of the enquiry. Indeed, the data was further analysed with the HEAT tool, mentioned above. The data of the current frequency of active transport and its supposed future increase was inserted in the HEAT tool, giving the following results: 13 deaths prevented every year and a 50% higher safety for cyclist compared to non-cyclists.

From an economic point of view, PA significantly affects direct and indirect healthcare costs and has a significant impact on productivity and on good health (30). Policies that encourage PA represent a strong investment towards the prevention of NCDs and the improvement of health and quality of life.

As the experience of this research group shows, cooperation between different sectors is crucial, especially between health sector operators and town planners. Lastly, the choice of questionnaires to collect predictions of citizens’ future

intentions is not only useful to policy makers but also constitutes a relevant scientific support for planners, facilitating them in making decisions in the Urban Health field.

These tools were tested and validated for the first time in the District 7 of Milan, and their effectiveness on data collection properly evaluated; the survey is currently being submitted to all nine Districts of the city. This will allow to run comparisons that would take into account the different quality conditions of the various city areas and the features of the urban environment favourable to active transportation and in turn to the adoption of healthy lifestyles.

Acknowledgements

The research work was possible thanks to the citizens interviewed in District 7 of Milan (residents, workers, students, etc.) who joined the survey. The collaboration of associations, sporting clubs, libraries and civic centres in the same area was crucially important and justified a printed version of the questionnaire.

Riassunto

Misurare l'incremento previsionale della ciclabilità nella città di Milano e valutare le ricadute positive sullo stato di salute della popolazione: un'esperienza di Community-Based Urban Planning

Stato dell'arte. È scientificamente noto quanto la sedentarietà sia tra i principali fattori di rischio per l'aumento delle malattie cronico-degenerative. Uno dei fattori che incide sulla scelta del mezzo di trasporto, per quanto riguarda gli spostamenti urbani, è la morfologia della città, ovvero la dotazione infrastrutturale a servizio della mobilità lenta. La ciclabilità infatti può contribuire ad aumentare il livello giornaliero di attività fisica, diventando quindi una fattore protettivo per la salute individuale.

Metodo. Dopo un aggiornamento dello stato dell'arte relativo agli strumenti di valutazione della correlazione tra ambiente costruito, trasporto attivo e quantificazione del livello di attività fisica, è stato redatto un questionario per raccogliere informazioni sull'attuale livello di ciclabilità urbana, nonché l'incremento previsto in caso di miglioramento ed implementazione della rete ciclabile. Il questionario ha indagato inoltre aspetti socio-

sanitari relativi all'anamnesi dei soggetti intervistati (età, sesso, stato di salute, attività fisica) e opinioni dei diretti fruitori sulle infrastrutture esistenti e sugli interventi in programma, finalizzati alla promozione della mobilità ciclabile. Scopo dell'indagine è stato quello di quantificare l'incremento di attività fisica correlato ad un previsionale miglioramento infrastrutturale, quantificandone attraverso strumenti statici, le ricadute positive in termini di salute.

Risultati. I dati raccolti (343 intervistati in un quartiere di Milano, Zona 7) dimostrano come, attraverso il miglioramento della rete ciclabile, ci sia un aumento del numero di ciclisti che riuscirebbe a raggiungere i 150 minuti settimanali di attività fisica raccomandata dall'OMS: il tempo trascorso in bicicletta aumenta infatti del 34,4% rispetto all'attuale livello di ciclabilità rilevato dall'indagine effettuata.

Conclusioni. L'indagine condotta ha confermato che gli interventi urbani, soprattutto quelli a piccola scala, potrebbero avere un ruolo chiave nella promozione di corretti stili di vita quindi importanti effetti positivi sulla salute della popolazione. È stata condotta infine un'applicazione dello strumento "Health Economic Assessment Tool" dell'OMS per valutare i benefici in termini di riduzione delle malattie cronico-degenerative, nello specifico una quantificazione previsionale delle morti risparmiate.

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